

# Noble Energy

Weld County, CO (NAD 83)

Sec. 24-T6N-R63W (Wells Ranch USX AA23 Middle PAD)

Wells Ranch USX AA23-66-1HN

Design: Vaughn ESS and Sperry MWD Survey

## Sperry Drilling Services

### Final Survey Report

20 September, 2013

Well Coordinates: 1,417,214.61 N, 3,307,640.94 E (40° 28' 24.20" N, 104° 23' 39.05" W)

Ground Level: 4,808.00 ft

Local Coordinate Origin: Centered on Well Wells Ranch USX AA23-66-1HN -

Viewing Datum: KB=30' @ 4838.00ft (H&P 321)

TVDs to System: N

North Reference: Grid

Unit System: API - US Survey Feet - Custom

Geodetic Scale Factor Applied

Version: 2003.16 Build: 431

**HALLIBURTON**

## Design Report for Wells Ranch USX AA23-66-1HN - Vaughn ESS and Sperry MWD Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
310.00	0.60	89.10	309.99	0.03	1.62	-1.62	0.19
<b>Surveys from 310.00ft to 603.00ft are Vaughn ESS Surveys</b>							
359.00	1.20	29.50	358.99	0.48	2.13	-2.15	2.11
448.00	2.00	31.30	447.95	2.61	3.40	-3.51	0.90
541.00	1.20	1.70	540.92	4.97	4.27	-4.48	1.21
603.00	0.10	348.70	602.91	5.68	4.28	-4.52	1.78
<b>Tie-On to Vaughn ESS Survey</b>							
669.00	0.69	26.66	668.91	6.09	4.45	-4.70	0.93
<b>First Sperry MWD Survey</b>							
721.00	0.56	14.60	720.91	6.61	4.65	-4.93	0.35
813.00	0.68	26.14	812.90	7.54	5.00	-5.32	0.19
904.00	0.83	22.89	903.89	8.63	5.50	-5.87	0.17
997.00	0.39	68.87	996.89	9.37	6.06	-6.45	0.67
1,090.00	0.76	29.34	1,089.89	10.02	6.65	-7.08	0.56
1,181.00	0.15	307.74	1,180.88	10.62	6.85	-7.31	0.83
1,274.00	0.13	125.36	1,273.88	10.63	6.84	-7.30	0.30
1,365.00	0.07	214.43	1,364.88	10.52	6.90	-7.34	0.16
1,457.00	0.77	237.73	1,456.88	10.15	6.34	-6.77	0.77
1,552.00	1.86	241.23	1,551.85	9.06	4.45	-4.84	1.15
1,647.00	2.68	232.17	1,646.78	6.96	1.35	-1.64	0.94
1,742.00	4.67	238.75	1,741.58	3.59	-3.72	3.56	2.14
1,837.00	6.94	241.22	1,836.08	-1.18	-12.05	12.09	2.40
1,932.00	8.47	240.17	1,930.22	-7.42	-23.15	23.45	1.62
2,026.00	10.53	238.17	2,022.93	-15.40	-36.46	37.09	2.22
2,121.00	9.72	225.48	2,116.46	-25.60	-49.55	50.61	2.49
2,216.00	10.07	227.83	2,210.05	-36.80	-61.43	62.96	0.56
2,311.00	10.79	226.50	2,303.48	-48.49	-74.03	76.06	0.80
2,405.00	9.92	225.11	2,395.95	-60.27	-86.15	88.67	0.96
2,500.00	10.73	226.01	2,489.41	-72.18	-98.31	101.33	0.87
2,595.00	11.44	227.66	2,582.64	-84.67	-111.64	115.19	0.82
2,689.00	10.23	224.54	2,674.96	-96.90	-124.38	128.45	1.43
2,784.00	10.40	223.50	2,768.42	-109.13	-136.20	140.78	0.27
2,879.00	9.52	218.00	2,861.99	-121.54	-146.94	152.05	1.36
2,973.00	9.54	223.79	2,954.70	-133.29	-157.12	162.72	1.02
3,068.00	8.22	222.69	3,048.56	-143.97	-167.17	173.23	1.40
3,162.00	5.83	223.51	3,141.84	-152.37	-175.02	181.43	2.54
3,257.00	4.12	223.48	3,236.48	-158.35	-180.69	187.35	1.80
3,351.00	2.64	245.50	3,330.32	-161.70	-184.98	191.78	2.07
3,446.00	1.58	206.93	3,425.26	-163.77	-187.57	194.46	1.81
3,541.00	1.28	151.33	3,520.23	-165.87	-187.65	194.63	1.43
3,636.00	0.49	148.23	3,615.22	-167.15	-186.93	193.96	0.83
3,731.00	0.47	155.38	3,710.22	-167.85	-186.55	193.62	0.07
3,826.00	0.33	119.66	3,805.22	-168.34	-186.15	193.24	0.29
3,920.00	0.43	10.96	3,899.22	-168.12	-185.85	192.93	0.66
4,015.00	0.83	16.91	3,994.21	-167.11	-185.58	192.62	0.43
4,110.00	0.06	53.10	4,089.21	-166.43	-185.34	192.35	0.82
4,205.00	0.25	143.79	4,184.21	-166.56	-185.18	192.19	0.27
4,300.00	0.22	189.55	4,279.20	-166.91	-185.09	192.11	0.19
4,394.00	0.11	225.38	4,373.20	-167.15	-185.18	192.22	0.16

## Design Report for Wells Ranch USX AA23-66-1HN - Vaughn ESS and Sperry MWD Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
4,489.00	0.56	123.83	4,468.20	-167.47	-184.86	191.91	0.62
4,584.00	0.28	162.61	4,563.20	-167.95	-184.41	191.48	0.40
4,679.00	0.67	111.68	4,658.20	-168.38	-183.82	190.91	0.57
4,774.00	1.08	86.37	4,753.19	-168.53	-182.41	189.51	0.58
4,869.00	2.54	83.46	4,848.14	-168.23	-179.42	186.51	1.54
4,964.00	1.49	48.85	4,943.08	-167.18	-176.40	183.45	1.64
5,058.00	1.18	62.60	5,037.05	-165.93	-174.62	181.62	0.47
5,153.00	1.32	115.41	5,132.03	-165.95	-172.77	179.76	1.18
5,247.00	1.69	132.51	5,226.00	-167.35	-170.77	177.83	0.61
5,342.00	1.23	113.43	5,320.97	-168.70	-168.80	175.92	0.70
5,437.00	0.99	83.39	5,415.95	-169.01	-167.05	174.18	0.65
5,532.00	2.22	99.44	5,510.92	-169.22	-164.42	171.56	1.37
5,627.00	1.27	41.50	5,605.88	-168.74	-161.90	169.03	1.98
5,722.00	1.42	4.19	5,700.85	-166.77	-161.12	168.16	0.92
5,816.00	1.38	346.57	5,794.83	-164.51	-161.30	168.24	0.46
5,903.00	1.48	341.93	5,881.80	-162.42	-161.89	168.75	0.18
5,965.00	1.33	345.43	5,943.78	-160.97	-162.32	169.11	0.28
6,006.00	1.47	339.19	5,984.77	-160.01	-162.63	169.38	0.50
6,054.00	4.83	288.60	6,032.69	-158.79	-164.76	171.46	8.46
6,100.00	10.26	287.30	6,078.28	-156.96	-170.51	177.12	11.81
6,148.00	15.19	281.44	6,125.09	-154.44	-180.76	187.26	10.60
6,195.00	19.08	275.40	6,170.00	-152.49	-194.45	200.85	9.09
6,243.00	21.73	271.28	6,214.98	-151.55	-211.15	217.49	6.28
6,289.00	24.36	268.71	6,257.31	-151.58	-229.15	235.48	6.12
6,337.00	28.85	266.67	6,300.22	-152.47	-250.62	256.97	9.54
6,384.00	33.25	267.10	6,340.47	-153.78	-274.82	281.20	9.37
6,432.00	36.71	268.55	6,379.80	-154.81	-302.31	308.71	7.41
6,479.00	40.72	270.52	6,416.46	-155.03	-331.70	338.08	8.92
6,527.00	44.45	273.03	6,451.80	-154.00	-364.15	370.46	8.54
6,574.00	49.13	273.49	6,483.97	-152.05	-398.34	404.53	9.98
6,622.00	53.37	270.86	6,514.01	-150.65	-435.74	441.83	9.81
6,669.00	57.50	266.82	6,540.68	-151.47	-474.41	480.50	11.28
6,717.00	62.96	265.27	6,564.50	-154.36	-515.96	522.14	11.71
6,764.00	67.26	266.90	6,584.28	-157.26	-558.48	564.75	9.67
6,812.00	72.06	267.03	6,600.96	-159.64	-603.41	609.74	10.00
6,858.00	76.03	266.77	6,613.60	-162.03	-647.57	653.95	8.65
6,906.00	78.40	267.99	6,624.22	-164.17	-694.33	700.76	5.52
6,941.00	80.43	268.47	6,630.65	-165.23	-728.71	735.16	5.95
6,996.00	83.27	269.68	6,638.45	-166.11	-783.14	789.58	5.60
<b>Estimated 7" Casing Point: 2307' FNL, 709' FEL (Not a Survey Station)</b>							
7,020.00	84.51	270.20	6,641.00	-166.13	-807.01	813.42	5.60
7,090.00	84.45	269.24	6,647.74	-166.47	-876.68	883.04	1.37
7,185.00	86.04	269.36	6,655.61	-167.63	-971.34	977.67	1.68
7,279.00	88.30	269.46	6,660.25	-168.60	-1,065.22	1,071.50	2.41
7,374.00	91.54	270.38	6,660.39	-168.73	-1,160.20	1,166.40	3.55
7,469.00	91.51	271.28	6,657.86	-167.35	-1,255.16	1,261.21	0.95
7,563.00	92.28	281.00	6,654.74	-157.32	-1,348.45	1,353.99	10.37
7,658.00	90.96	287.47	6,652.05	-133.98	-1,440.45	1,444.89	6.95
7,753.00	88.03	282.01	6,652.89	-109.82	-1,532.27	1,535.59	6.52
7,847.00	86.27	277.90	6,657.57	-93.59	-1,624.72	1,627.25	4.75
7,942.00	87.69	275.21	6,662.57	-82.76	-1,718.96	1,720.93	3.20

## Design Report for Wells Ranch USX AA23-66-1HN - Vaughn ESS and Sperry MWD Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
8,036.00	90.83	270.85	6,663.79	-77.80	-1,812.78	1,814.45	5.72
8,131.00	92.66	267.75	6,660.89	-78.96	-1,907.72	1,909.35	3.79
8,225.00	92.78	266.37	6,656.43	-83.77	-2,001.49	2,003.24	1.47
8,320.00	91.14	266.61	6,653.18	-89.58	-2,096.25	2,098.16	1.74
8,415.00	90.40	266.48	6,651.91	-95.31	-2,191.07	2,193.14	0.79
8,510.00	91.63	265.89	6,650.22	-101.63	-2,285.84	2,288.10	1.44
8,605.00	92.22	266.73	6,647.03	-107.74	-2,380.59	2,383.02	1.08
8,699.00	90.40	266.55	6,644.88	-113.25	-2,474.40	2,476.98	1.95
8,794.00	88.71	266.12	6,645.62	-119.32	-2,569.20	2,571.95	1.84
8,889.00	89.78	265.90	6,646.87	-125.93	-2,663.96	2,666.91	1.15
8,984.00	88.76	266.37	6,648.08	-132.33	-2,758.73	2,761.87	1.18
9,079.00	89.07	265.64	6,649.88	-138.95	-2,853.48	2,856.82	0.83
9,174.00	88.99	264.87	6,651.49	-146.81	-2,948.14	2,951.73	0.81
9,268.00	90.65	267.54	6,651.79	-153.03	-3,041.92	3,045.69	3.34
9,363.00	90.34	266.62	6,650.97	-157.87	-3,136.80	3,140.69	1.02
9,458.00	90.03	267.24	6,650.66	-162.95	-3,231.66	3,235.68	0.73
9,553.00	91.39	270.91	6,649.48	-164.49	-3,326.62	3,330.62	4.12
9,648.00	89.78	270.58	6,648.51	-163.25	-3,421.60	3,425.46	1.73
9,743.00	88.98	269.30	6,649.54	-163.35	-3,516.60	3,520.37	1.59
9,838.00	89.35	268.83	6,650.92	-164.90	-3,611.57	3,615.32	0.63
9,932.00	90.31	268.64	6,651.20	-166.98	-3,705.55	3,709.30	1.04
10,027.00	88.86	267.87	6,651.89	-169.87	-3,800.50	3,804.29	1.73
10,121.00	89.66	268.03	6,653.10	-173.23	-3,894.43	3,898.28	0.87
10,216.00	89.91	267.89	6,653.46	-176.61	-3,989.37	3,993.27	0.30
10,311.00	90.49	266.79	6,653.13	-181.02	-4,084.26	4,088.27	1.31
10,406.00	88.74	267.29	6,653.77	-185.93	-4,179.13	4,183.26	1.92
10,501.00	88.92	267.29	6,655.71	-190.42	-4,274.01	4,278.24	0.19
10,596.00	89.23	266.73	6,657.24	-195.37	-4,368.86	4,373.22	0.67
10,690.00	88.89	266.12	6,658.78	-201.23	-4,462.67	4,467.19	0.74
10,785.00	88.33	265.14	6,661.09	-208.47	-4,557.36	4,562.11	1.19
10,879.00	89.08	266.64	6,663.21	-215.21	-4,651.09	4,656.05	1.78
10,974.00	89.45	267.68	6,664.43	-219.91	-4,745.97	4,751.03	1.16
11,014.00	89.82	267.92	6,664.69	-221.45	-4,785.94	4,791.03	1.10

## Final Sperry MWD Survey

11,078.00	89.82	267.92	6,664.89	-223.77	-4,849.89	4,855.03	0.00
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Survey Projection to TD - Estimated BHL: 2324' FNL, 536' FWL

Design Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
310.00	309.99	0.03	1.62	Surveys from 310.00ft to 603.00ft are Vaughn ESS Surveys
603.00	602.91	5.68	4.28	Tie-On to Vaughn ESS Survey
669.00	668.91	6.09	4.45	First Sperry MWD Survey
6,996.00	6,638.45	-166.11	-783.14	Estimated 7" Casing Point: 2307' FNL, 709' FEL (Not a Survey Station)
11,014.00	6,664.69	-221.45	-4,785.94	Final Sperry MWD Survey
11,078.00	6,664.89	-223.77	-4,849.89	Survey Projection to TD
11,078.00	6,664.89	-223.77	-4,849.89	Estimated BHL: 2324' FNL, 536' FWL

Design Report for Wells Ranch USX AA23-66-1HN - Vaughn ESS and Sperry MWD Survey

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin +N/_S (ft)	Origin +E/-W (ft)	Start TVD (ft)
Target	Wells Ranch USX AA23-66-1HN_RevA0_BHL Tgt	267.53	Slot	0.00	0.00	0.00

Survey tool program

From (ft)	To (ft)	Survey/Plan	Survey Tool
310.00	603.00	Vaughn ESS Surveys	Flexi-Shot
669.00	6,996.00	Sperry MWD Surveys	MWD
6,996.00	11,078.00	Sperry MWD Surveys	MWD

Casing Details

Measured Depth (ft)	Vertical Depth (ft)	Name	Casing Diameter (")	Hole Diameter (")
638.00	637.91	9 5/8" Csg	9-5/8	13-3/4
6,996.00	6,638.45	7" Csg	7	8-3/4

## Design Report for Wells Ranch USX AA23-66-1HN - Vaughn ESS and Sperry MWD Survey

**Targets**

Target Name - hit/miss target - Shape	Dip Angle (°)	Dip Dir. (°)	TVD (ft)	+N/-S (ft)	+E/-W (ft)	Northing (ft)	Easting (ft)	Latitude	Longitude
Wells Ranch USX	0.00	0.00	-2.00	-76.50	0.95	1,417,138.11	3,307,641.89	40.473180	-104.394180
- actual wellpath misses target center by 76.54ft at 0.00ft MD (0.00 TVD, 0.00 N, 0.00 E)									
- Polygon									
Point 1				-71.05	2,148.50	1,419,363.03	3,307,569.89		
Point 2				5,185.95	2,203.50	1,419,418.03	3,312,826.71		
Point 3				5,214.95	-3,096.50	1,414,118.22	3,312,855.71		
Point 4				-78.05	-3,152.50	1,414,062.22	3,307,562.89		
Point 5				-71.05	2,148.50	1,419,363.03	3,307,569.89		
Wells Ranch USX	0.00	0.00	-2.00	-76.50	0.95	1,417,138.11	3,307,641.89	40.473180	-104.394180
- actual wellpath misses target center by 76.54ft at 0.00ft MD (0.00 TVD, 0.00 N, 0.00 E)									
- Polygon									
Point 1				-531.05	1,688.50	1,418,903.05	3,307,109.91		
Point 2				-538.05	-2,692.50	1,414,522.20	3,307,102.91		
Point 3				-4,907.05	-2,728.50	1,414,486.20	3,302,734.07		
Point 4				-4,941.05	1,633.50	1,418,848.05	3,302,700.07		
Point 5				-531.05	1,688.50	1,418,903.05	3,307,109.91		
Wells Ranch USX	0.00	0.00	-2.00	-76.50	0.95	1,417,138.11	3,307,641.89	40.473180	-104.394180
- actual wellpath misses target center by 76.54ft at 0.00ft MD (0.00 TVD, 0.00 N, 0.00 E)									
- Polygon									
Point 1				388.95	1,688.50	1,418,903.05	3,308,029.88		
Point 2				4,725.95	1,743.50	1,418,958.04	3,312,366.72		
Point 3				4,754.95	-2,636.50	1,414,578.20	3,312,395.72		
Point 4				381.95	-2,692.50	1,414,522.20	3,308,022.88		
Point 5				388.95	1,688.50	1,418,903.05	3,308,029.88		
Wells Ranch USX	0.00	0.00	-2.00	-76.50	0.95	1,417,138.11	3,307,641.89	40.473180	-104.394180
- actual wellpath misses target center by 76.54ft at 0.00ft MD (0.00 TVD, 0.00 N, 0.00 E)									
- Polygon									
Point 1				-71.05	2,148.50	1,419,363.03	3,307,569.89		
Point 2				-78.05	-3,152.50	1,414,062.22	3,307,562.89		
Point 3				-5,367.05	-3,188.50	1,414,026.22	3,302,274.08		
Point 4				-5,401.05	2,093.50	1,419,308.03	3,302,240.08		
Point 5				-71.05	2,148.50	1,419,363.03	3,307,569.89		
Wells Ranch USX	0.00	0.00	6,667.91	-209.39	-4,849.93	1,417,005.23	3,302,791.18	40.472980	-104.411620
- actual wellpath misses target center by 14.68ft at 11077.53ft MD (6664.89 TVD, -223.75 N, -4849.42 E)									
- Point									

## North Reference Sheet for Sec. 24-T6N-R63W (Wells Ranch USX AA23 Middle PAD) - Wells Ranch USX AA23-66-1HN

All data is in US Feet unless otherwise stated. Directions and Coordinates are relative to Grid North Reference.

Vertical Depths are relative to KB=30' @ 4838.00ft (H&P 321). Northing and Easting are relative to Wells Ranch USX AA23-66-1HN - Slot A3

Coordinate System is US State Plane 1983, Colorado Northern Zone using datum North American Datum 1983, ellipsoid GRS 1980

Projection method is Lambert Conformal Conic (2 parallel)

Central Meridian is -105.500000°, Longitude Origin:0.000000°, Latitude Origin:40.783333°

False Easting: 3,000,000.00ft, False Northing: 1,000,000.00ft, Scale Reduction: 0.99996438

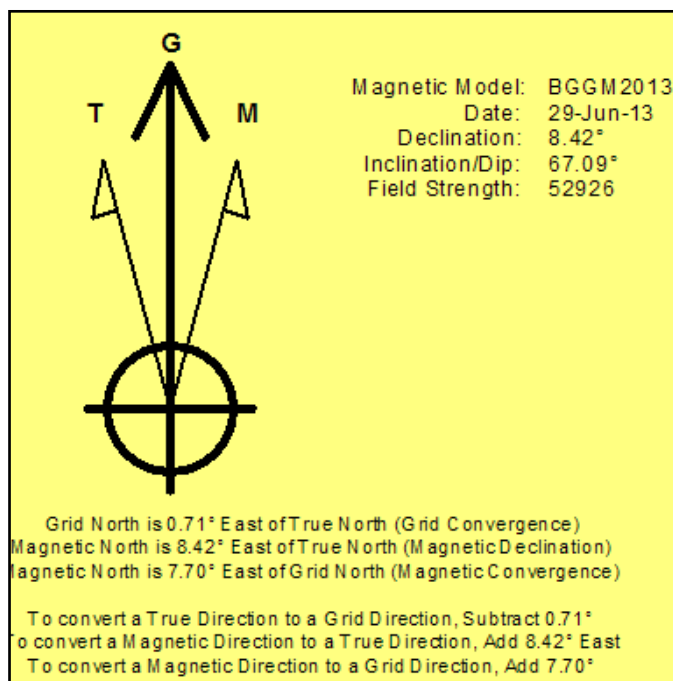
Grid Coordinates of Well: 1,417,214.61 ft N, 3,307,640.94 ft E

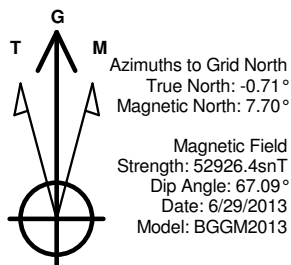
Geographical Coordinates of Well: 40° 28' 24.20" N, 104° 23' 39.05" W

Grid Convergence at Surface is: 0.71°

Based upon Minimum Curvature type calculations, at a Measured Depth of 11,078.00ft the Bottom Hole Displacement is 4,855.05ft in the Direction of 267.36° (Grid).

Magnetic Convergence at surface is: -7.70° (29 June 2013, , BGGM2013)



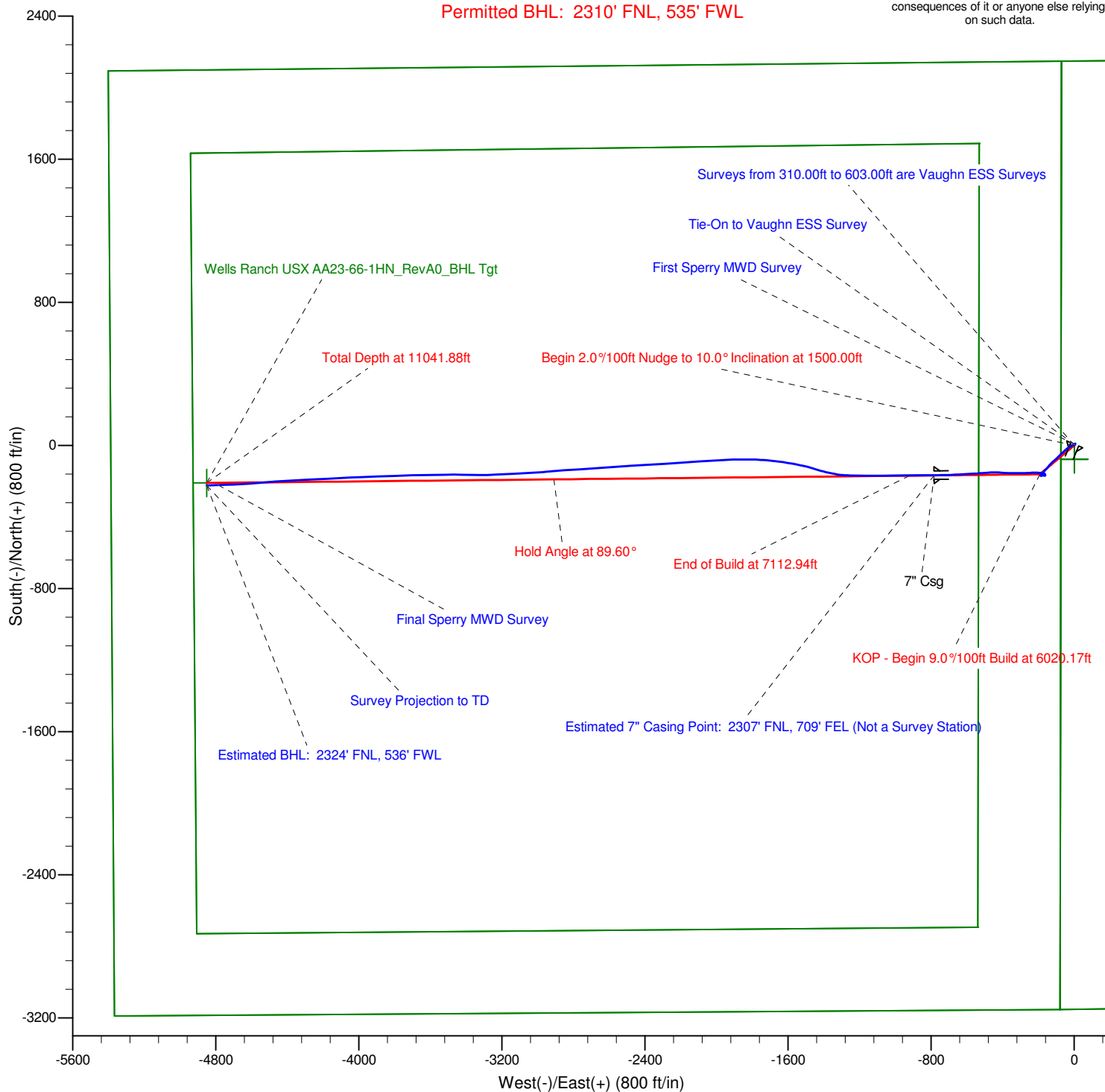


### LEGEND

- Wells Ranch USX AA23-66-1HN, Plan A, Rev A0 Proposal V0
- Vaughn ESS and Sperry MWD Survey

Halliburton Energy Services, Inc. ("Halliburton") recently completed directional drilling and MWD operations at the Wells Ranch USX AA23-66-1HN well located at Weld County, CO. At the conclusion of the job Halliburton performed a final survey on the well. Noble Energy has requested that Halliburton provide them the distances from BHL to section lines from that final survey to allow Noble Energy to meet its requirements under Colorado law. These distances are generated by a mathematical algorithm based on rough data collected after the well is drilled. Halliburton considers it to be a rough estimate only and it is not to be relied upon in any application where accurate data is required. In consideration for Halliburton releasing this data to Noble Energy, Noble Energy agrees to release Halliburton from any consequences of it or anyone else relying on such data.

Permitted BHL: 2310' FNL, 535' FWL





Project: Weld County, CO (NAD 83)  
Site: Sec. 24-T6N-R63W (Wells Ranch USX AA23 Middle PAD)  
Well: Wells Ranch USX AA23-66-1HN

# Noble Energy

**HALLIBURTON**

Sperry Drilling



Azimuths to Grid North  
True North:  $-0.71^\circ$   
Magnetic North:  $7.70^\circ$

Magnetic Field  
Strength: 52926.4snT  
Dip Angle:  $67.09^\circ$   
Date: 6/29/2013  
Model: BGGM2013

## LEGEND

- Wells Ranch USX AA23-66-1HN, Plan A, Rev A0 Proposal V0
- Vaughn ESS and Sperry MWD Survey

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